REMARKS

This amendment, submitted in response to the Office Action dated February 13, 2003, is believed to be fully responsive to each point of rejection raised therein. Accordingly, favorable reconsideration is respectfully requested.

In response to the claim objections raised by the Examiner, claims 2-4, and 6 have been amended as indicated in the Appendix, to overcome the claim objections. With respect to the Examiner's objection to claim 4, Applicant has not amended claim 4 to read "predetermined distance in the subscanning direction is Wf" instead of "predetermined distance is Wf" since the distance Wf is not in the subscanning direction, and its value is not based on the direction of scanning. In addition, claim 4 does not further define the first and the second beam pitches, but further defines the predetermined distance between the beam emitting ports in the multiple beam forming light source recited in cancelled claim 1 and in newly amended claim 2.

In addition, Fig. 1 has been amended to include reference numeral 31 which is described in the specification on page 16.

Claims 1-8 are pending in the Application. Claims 2 and 5 have been rejected under 35 U.S.C. § 112, second paragraph as being indefinite. Claims 1-3 and 6-8 have been rejected under 35 U.S.C. § 102(e) as being anticipated by Kubokawa (USP 6,330,019 B1). Alternatively, claims 1-3 and 6-8 have been rejected under 35 U.S.C. § 102(e) as being anticipated by Inoue et al. (Pub. No. 2002/0015088 A1). Claims 4 and 5 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over Inoue.

Pursuant to a teleconference with the Examiner on March 13, 2003, the Examiner indicated that Tsukada et al on page 5 of the Office Action should read Kubokawa.

Applicant submits the following arguments in traversal of the rejections.

Rejection of claims 2 and 5 under 35 U.S.C. § 112, second paragraph

Claim 2 has been amended as suggested by the Examiner to overcome the section 112 rejection. Claim 5 has been amended to be dependent upon claim 4. Therefore, the variables are now clearly defined.

Rejection of claims 2, 3 and 6-8 under 35 U.S.C. § 102(e)

as being anticipated by Inoue

Claim 1 has been cancelled and claim 2 has been amended to include the features of claim 1. Claim 2 should be deemed patentable based on the arguments set forth below. In addition, claims 3, 4, and 7 have been amended to be dependent upon claim 2. Claim 8 has been amended to include the tilt angle changing unit of claim 2.

The tilt angle changing unit of claim 2, is not disclosed in the prior art. The Examiner maintains that Inoue suggests to tilt the multibeam light source in the subscanning direction to obtain a desired resolution. Paragraph [0209]. Claim 2 describes a tilt angle changing unit which rotates the multibeam light source resulting in a first and a second exposure condition.

Paragraph [0209] of Inoue describes an inclination added to the beam irradiation sources in order to obtain a desired resolution. The beam irradiation sources are arranged without complicating the electric circuit for controlling timing of imaging. There does not appear to be a tilt angle changing unit which rotates the multibeam light source. It appears that the beam irradiation sources are formed and arranged on an optical fiber array apparatus with an incline. The incline is not a result of rotating the multibeam light source with a tilt angle changing unit. Therefore, claim 2 and its dependent claims should be deemed patentable.

In addition, with respect to claim 6, Inoue mentions that a lens could be used, but it does not teach that the lens finely adjusts imaging magnification of the optical system. Since the Examiner has not met all of the elements of the claims, the anticipation rejection of claims 2, 3 and 6-8 should fail.

Rejection of claims 4 and 5 under 35 U.S.C. § 103(a) as being unpatentable over Inoue

Claim 4 describes the variables for obtaining a predetermined distance between a first and a second multiple beam forming light source. Claim 5 describes the variables for obtaining the shift distance between a first and a second multiple beam forming light source.

Inoue does not teach that variables such as magnification and pitch are considered in determining the distance between light sources and a shift distance, as described in claims 4 and 5.

In addition, *In re Boesch*, 205 USPQ 215 (CCPA 1980) is distinguishable from the present situation because *In re Boesch* involved ranges for chemicals. The court found that since the compositional limits in the prior art overlapped with those that were being claimed by the Appellants, that the Appellants' invention was obvious. Id. at 218-9. Firstly, in the present situation, we are not dealing with ranges of chemical compositions. Secondly, the Examiner has not provided any reference describing the variables and values described in claims 4 and 5. Therefore, there is no overlapping and claims 4 and 5 are not obvious.

Rejection of claims 2, 3, and 6-8 under 35 U.S.C. § 102(e)

as being anticipated by Kubokawa

Claim 2 has been amended to include the features of claim 1 and claim 1 has consequently been canceled. Applicant submits that the features of now independent claim 2 are not described in Kubokawa. The Examiner maintains col. 1, lines 27-35 of Kubokawa discloses a tilt angle changing unit as described in the present invention. Kubokawa describes that in order to achieve recording with higher resolution, substrates that fix optical fibers may be tilted so as to substantially shorten the distance between tow neighboring optical fibers in the subscanning direction. Column 1, lines 32-35.

Although Kubokawa describes tilting optical fibers, Kubokawa does not describe a tilt angle changing *unit* which makes by rotating a multibeam light source, a change in exposure condition from a first exposure condition to a second exposure condition, as described in the present invention. Therefore, claim 2 and its dependent claims should be deemed patentable.

Also, Kubokawa appears to teach away from tilting. In particular, when tilting the substrates to obtain higher resolution, they must be tilted accurately, which would require the image recording apparatus to be provided with a controller for controlling the inclination of the substrates which would mean additional costs. Column 1, lines 49-54. Moreover, improving resolution requires the angle of tilting the substrates to be increased. However, a greater angle may cause the inconvenience of increasing the possibility of different laser beams overlapping one another. Column 1, lines 54-58. Therefore, Kubokawa teaches a mechanism other than a tilt angle changing unit to improve recording speed and picture quality.

In addition, Applicant has added claims 9-14 to describe the invention more particularly.

AMENDMENT UNDER 37 C.F.R. § 1.111
U.S. Appln. No.: 09/998,427

In view of the above, reconsideration and allowance of this application are now believed to be in order, and such actions are hereby solicited. If any points remain in issue which the Examiner feels may be best resolved through a personal or telephone interview, the Examiner is kindly requested to contact the undersigned at the telephone number listed below.

The USPTO is directed and authorized to charge all required fees, except for the Issue Fee and the Publication Fee, to Deposit Account No. 19-4880. Please also credit any overpayments to said Deposit Account.

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APPENDIX

VERSION WITH MARKINGS TO SHOW CHANGES MADE

IN THE SPECIFICATION:

Page 2, lines 14-21.

On the other hand, the recording density needs to be increased to 2400 dpi, 3600 dpi and 5000 dpi for increasing halftone levels and image quality of printed images. The plate-making time needs to be shortened while increasing the recording density to such a level. There is a demand for high-density ~~drawing~~ drawings in a shorter time not only in the printing field but also in other various image recording fields.

Page 2, line 22 to page 3, line 8.

However, an apparatus cannot be realized, which is capable of performing such high-density drawing with one light beam because the number of revolutions of a drum around which the PS plate needs to be fitted and which is rotated for scanning in the main scanning direction must be set to 10000 r.p.m. or greater. This can be established, considering any ~~of~~ structural, control and manufacturing-cost conditions. By considering this problem, multibeam exposure apparatuses have been proposed in which simultaneous exposure recording for several lines is performed using one row of light beams.

Page 3, line 9 to page 4, line 8.

Any of such multibeam exposure apparatuses ~~uses~~ use an optical fiber array or the like in the form of a row of optical fibers. The direction of one row of fibers in the optical fiber array is tilted from a main scanning direction to reduce a pitch of multiple beams emitted from the

optical fiber array according to a selected resolution, thereby enabling exposure recording on a PS plate to be performed while changing resolution between various values, e.g., 2400 dpi, 3600 dpi and 5000 dpi. If an optical fiber array having a larger number of optical fibers arranged in a row is used to effectively reduce the exposure recording time at once, it is necessary to increase the number of optical fibers arranged in a row. If the number of optical fibers arranged in a row is increased, the width of arrangement of multiple beams from the optical fiber array is necessarily increased since the lower limit of pitch of the optical fibers is set depending on the fiber diameter. Further, it is necessary to correspondingly increase a size of optical system lenses for imaging with the multiple beams on the PS plate. Therefore necessity for increasing the size of the exposure apparatus arises as well as the need for using low cost performance optical system lenses, resulting in increasing manufacturing cost of the exposure apparatus.

Page 6, lines 4 and 5.

In order to attain the above object, the following aspects will be provided by the preset invention.

Page 9, lines 5-9.

Further it is preferable that the head of the optical system ~~having~~ have a lens which finely adjusts imaging magnification of the optical system, the lens being provided in an optical path of the first multiple beams and the second multiple beams.

Page 9, lines 12-17.

The second aspect of the present invention is characterized by a multibeam apparatus having the multibeam exposure head described above according to the first aspect and an outer

drum capable of performing main scanning on the recording material by having the recording material fitted and rotated around its outer cylindrical surface.

Page 16, lines 3-7.

As shown in Fig. ~~1~~3, the tilt angle is θ_{min}. As understood from the placed position of the member 24f shown in Fig. 3, the tilt angle is not zero when minimized (the fiber arrays are not horizontal). The tilt angle in the state shown in Fig. 3 lies at the minimum.

IN THE CLAIMS:

Please cancel claim 1 without prejudice or disclaimer.

2. (Amended) ~~The~~ A multibeam exposure head ~~according to claim 1, further~~ comprising:

a multibeam light source which exposes a recording material by main scanning,

said multibeam light source having a first multiple beam forming light source in which a plurality of beam emitting ports are arranged parallel to each other while being spaced apart from each other by a predetermined distance, and a second multiple beam forming light source in which a plurality of beam emitting ports are arranged parallel to each other being spaced apart from each other by said predetermined distance,

wherein said plurality of beam emitting ports in said second multiple beam forming light source are placed parallel to the parallel arrangement direction of the beam emitting ports in said first multiple beam forming light source while being spaced apart by a predetermined distance from the same, and the position of the beam emitting port at one end of said second multiple beam forming light source being shifted in the parallel direction relative to the position of the beam emitting port at the corresponding end of said first multiple beam forming light source; and

a tilt angle changing unit which makes, by rotating said multibeam light source, a change in exposure condition from a first exposure condition in which each of first multiple beams emitted from said first multiple beam forming light source and each of second multiple beams emitted from said second multiple beam forming light source are alternatively arranged at a first ~~an~~ equal interval in a subscanning direction perpendicular to the direction of main scanning on a~~the~~ recording material, to a second exposure condition in which each of the first multiple beams and each of the second multiple beams are alternatively arranged at a second ~~an~~ equal interval in the ~~a~~ subscanning direction.

3. (Amended) The multibeam exposure head according to claim 2~~1~~, further comprising an optical system in an optical path between said multibeam light source and the recording material, from a first beam pitch formed on the recording material through said optical system by each of the first multiple beams and the second multiple beams alternatively arranged at first equal intervals in the subscanning direction under the first exposure condition, said multibeam light source being rotated by using said tilt angle changing unit to form a desired second beam pitch on the recording material through said ~~imaging~~ optical system by each of the first multiple beams and the second multiple beams alternatively arranged at second equal intervals in the subscanning direction under the second exposure condition.

4. (Amended) The multibeam exposure head according to claim 2~~1~~, wherein if the arrangement distance of said beam emitting ports is D_f; said first beam pitch is P; said second beam pitch is Q; and imaging magnification of ~~said~~ an optical system for said multibeam light source is M, and

if a distance by which said first multiple beam forming light source and said second multiple beam forming light source are spaced apart from each other by a predetermined distance is W_f, then W_f obtained by the following equation (1) is set:

$$W_f = L \cdot \cos(\theta_a + \Phi_1)/M \qquad (1)$$

where $L = (((2 \cdot n-1) \cdot Q + P \cdot \cos(\Delta\theta))/\sin(\Delta\theta))^2 + P^2)^{1/2}$,

$\theta_a = \cos^{-1}(2 \cdot P/(D_f \cdot M))$,

$\Phi_1 = \sin^{-1}(P/((((2 \cdot n-1) \cdot Q + P \cdot \cos(\Delta\theta))/\sin(\Delta\theta))^2 + P^2)^{1/2})$,

$\Delta\theta = \cos^{-1}(2 \cdot Q/(D_f \cdot M)) - \cos^{-1}(2 \cdot P/(D_f \cdot M))$, and

n is a natural number.

5. (Amended) The multibeam exposure head according to claim 4~~1~~, wherein if a width by which the position of the beam emitting port of said second multiple beam forming light source is shifted in the parallel arrangement direction relative to the position of the beam emitting port of said first multiple beam forming light source is A_f, then A_f obtained by the following equation (2) is set:

$$A_f = (W_f \cdot M \cdot \sin(\theta_a) + P)/(\cos(\theta_a) \cdot M) \qquad (2)$$

6. (Amended) The multibeam exposure head according to claim 3~~1~~, wherein said optical system ~~having~~ has a lens which finely adjusts imaging magnification of said optical system, said lens being provided in an optical path of the first multiple beams and the second multiple beams.

7. (Amended) The multibeam exposure head according to claim 2~~1~~, wherein said multibeam light source has~~having~~ an optical fiber array.

8. (Amended) A multibeam exposure apparatus comprising:

a multibeam exposure head including a multibeam light source which exposes a recording material by main scanning, said multibeam light source having a first multiple beam forming light source in which a plurality of beam emitting ports are arranged parallel to each other while being spaced apart from each other by a predetermined distance, and a second multiple beam forming light source in which a plurality of beam emitting ports are arranged parallel to each other being spaced apart from each other by said predetermined distance, wherein said plurality of beam emitting ports in said second multiple beam forming light source are placed parallel to the parallel arrangement direction of the beam emitting ports in said first multiple beam forming light source while being spaced apart by a predetermined distance from the same, and the position of the beam emitting port at one end of said second multiple beam forming light source is shifted in the parallel direction relative to the position of the beam emitting port at the corresponding end of said first multiple beam forming light source;

a tilt angle changing unit, wherein said tilt angle changing unit rotates said multibeam light source to change an exposure condition from a first exposure condition to a second exposure condition during a subscan of a width of an area of a recording material; and

an outer drum capable of performing main scanning on the recording material by having the recording material fitted and rotated around its outer cylindrical surface.

Claims 9-14 are added as new claims.

9. (New) The multibeam exposure head according to claim 3, further comprising a collimator lens and an imaging lens for reducing multiple beams at an image forming point.

10. (New) The multibeam exposure head according to claim 2, wherein said tilt angle changing unit comprises a rotary unit and a base unit.

11. (New) The multibeam exposure head according to claim 11, wherein said tilt angle changing unit further comprises a first member, a second member and a projecting member,

wherein said first member, said second member are located between the rotary unit and base unit, and

wherein said first member and said second member limit a tilt angle point by a predetermined range by limiting the movement of the projecting member fixed to the rotary unit.

12. (New) The multibeam exposure head according to claim 2, wherein said tilt angle changing unit and an optical system are fixed to a movable table.

13. (New) A multibeam exposure head comprising:

a multibeam light source which exposes a recording material by main scanning,

said multibeam light source having a first multiple beam forming light source in which a plurality of beam emitting ports are arranged parallel to each other while being spaced apart from each other by a predetermined distance, and a second multiple beam forming light source in which a plurality of beam emitting ports are arranged parallel to each other being spaced apart from each other by said predetermined distance,

wherein said plurality of beam emitting ports in said second multiple beam forming light source are placed parallel to the parallel arrangement direction of the beam emitting ports in said first multiple beam forming light source while being spaced apart by a predetermined distance from the same, and the position of the beam emitting port at one end of said second multiple beam forming light source being shifted in the parallel direction relative to the position of the beam emitting port at the corresponding end of said first multiple beam forming light source; and

wherein said second multiple beam forming light source is shifted in the parallel direction relative to the position of the beam emitting port at the corresponding end of said first multiple beam forming light source by a distance such that an end most beam source of the first multiple beam forming light source and an end most beam source of the second multiple beam forming light source do not overlap each other.

14. (New) The multibeam exposure head according to claim 2, wherein said tilt angle change unit makes, by rotating said multibeam light source, said change in exposure condition from said first exposure condition to said second exposure condition during a subscan of a width of an area of a recording material.